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ABSTRACT

Comparison of the attitudinal responses of eight-year-old children who studied science in a National Science Foundation sponsored program, "Science Curriculum Improvement Study," with responses of eight-year-old children who studied science using a textbook series, "Concepts in Science," showed no differences. However, both programs did appear to invoke a positive attitude toward science. Attitudes toward science, the scientific process, and the scientist were measured using the Projective Tests of Attitudes. (BB)

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PRIMARY STUDENTS' ATTITUDES TOWARDS SCIENCE

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PRIMARY STUDENTS' ATTITUDES TOWARD SCIENCE

The effect of students' attitudes toward the learning process has intuitively been assumed but only recently have educators begun to develop necessary instruments to measure these attitudes. What are children's attitudes toward science? We live in a world of science. It is necessary that children are exposed to the overlying concepts of such a world. These students will most likely not become scientists. However, if their attitudes towards science are negative it is unlikely that these students will benefit from the exposure to science that is most necessary for their survival.

A working definition of attitude is the "individual's organization of psychological processes, as inferred from his behavior or with respect to this future behavior it is as Sorenson and Voelker (1972) state "a predisposition toward action in a given direction." It represents parts of his past experiences with which he goes into new situation and with which the following behavior is influenced (Jahoda, 1966). With this definition in mind, we see that the attitudes a child carries influence his/her behavior and are acquired from events in the child's environment.

The child first comes to school very ready, open and anxious with "built-in" motivation. Then the drain of this excitement begins to show.

> Universally there is a paradox: first, the eager, vivid outreaching mind of the immature organism, the tremendous curiosity, the eagerness to make contact; then a few years later a loss of eager curiosity. Is the school losing the chance to build on the child's strongest motivation? (Murphy, 1971).

Or are we possibly observing a maturation which includes a move to the negative based on compiled experience?

There appears to be two basic divisions of the education of children. One is, certainly, can the child read, science, add, or perform whatever skill deemed necessary? The other question is not can the student perform but will he? Children's attitudes are shown to be extremely vital to their education. Estes (1971) takes the position that, how students feel about reading is as important as whether they actually are able to read. The value of skills and abilities is not merely in the possession of them but rather in the desire to use them. Important to note from Estes' study (1971) is that the younger pupils revealed more positive attitudes than did the older pupils. It would seem that the indication is the young child retains his natural curiosity toward learning. (Perrodin 1966). It appears certain that one must capitalize on children's natural curiosity and therefore gain an advantage for motivating children in the educational process. Before students can learn they must want to learn and be willing to learn.

The willingness or lack of continues through adulthood. Noted in the Cambridge report (EDC, 1969) is that most adults indicate by their attitudes that they feel threatened by things that are mathematical and scientific. If this is to change, it is felt by the members of the Cambridge conference that the

work must begin in the elementary school program.

Description

The purpose of this research was to develop and adapt a methodology for assessing children's attitudes towards science, the scientific process and the scientist, while at the same time measuring these attitudes for the purpose of evaluating selected elementary school science programs used in the St. Paul City Schools, St. Paul, Minnesota. More specifically, the study was designed to compare the attitudinal responses of eight-year-old children who studied science in a National Science Foundation sponsored program, Science Curriculum Improvement Study (Karplus, 1970) with those responses of eight-year-old children who studied science in a textbook series, Concepts in Science (Harcourt, Brace and World, Inc., 1966).

The study was designed 1) to identify a means in which to assess the children's attitudes towards science and 2) to add to the understanding of the eight-year-old child's thoughts and feelings concerning the field of science, the scientific process, and the professions of the scientists.

A random sample of eight-year-old children was selected from three elementary schools in St. Paul, Minnesota. A total of 79 children, 24 classes, 4 grade levels were represented. All children in the sample had been in the Concepts in Science, Harcourt, Brace and World, Inc., series from the time they entered school and up to the start of this research.

The Science Curriculum Improvement Study units Material Objects, Interactions, and Life Cycles were used in this study. SCIS involves three phases, 1) exploration, 2) invention, and 3) application. The children are actively involved and it is a non-textbook series.

The Concepts in Science program is a textbook series that has three phases for each unit, 1) problem identification, 2) concept development, and 3) reinforcement. The units used were those in the entire first, second, third, and fourth grade textbooks.

The Lorge-Thorndike Intelligence Tests, Level 2, Form A, was given to all students by the researcher. This form was used upon recommendation of the authors that it be given to students in low socioeconomic conditions such as those from which the sample was drawn.

The Projective Tests of Attitudes (PTOA) structured by Lawrence Lowery (1966) is composed of three interdependent techniques. The three tests of the PTOA are the Word Association Test, the Sentence Completion Test, and The Lawrence Lowery Apperception Test. Each test is purported to measure attitudes towards science, the scientific process and the scientist. All three measures were adapted to be administered verbally and required verbal responses on the part of the children, through the use of tape recorders. As Perrodin (1966) states, projective type instruments encourage children to express themselves. In this case this is enhanced by the use of a verbal technique as opposed to a written one.

The scoring of the three tests was done on a scale that rated the response of each child to each item as negative, neutral or positive. Each of the 21 responses of each child was also categorized.

The PTOA was administered to both the experimental and control samples in the spring of the academic year, following a full school term of the experimental sample working in the SCIS program and the control samples continuing through the year with the Concepts in Science series.

Results and Conclusions

On the basis of the findings generated from the data in this study it appears that the program does not make a difference in eight-year-olds' attitudes toward science, the scientist, and the science process. These results coincide with those of Vanek and Montean (1977). Longer range research which is often recommended (Vanke and Montean, 1977) was carried out in this study. The results show no differences in programs but do show that eight-year-old children in both programs universally demonstrated a positive attitude toward science. The lack of significant differences between the responses of students in Concepts in Science and SCIS suggests that both programs do what they purport to do -- namely, create or at least maintain positive attitudes towards science. Perhaps as indicated in Johnson, Ryan, and Schroeder's Study (1974), and Vanek and Montean's work (1977) that the pendulum has swung too far past middle away from text programs. These studies demonstrate that a lack of differences between programs exists in relation to attitudes toward science.

To have a closer look at their positive responses, each answer that every child gave as a response to items on the PTOA was classified under a category. There are 22 categories that a response could be listed within. The assumption being that the types of responses the children would give to the stimulus in the three tests would be indicative of their interests and thinking in the area of science.

Lowery listed 16 categories (1966) and these 16 listings were used in this study. However, the judges found an additional six topics that were frequently mentioned. Therefore, in order to accommodate those topics an additional six categories were listed.

There is evidence that these eight-year-olds responded differently to science topics than Lowery's ten-year-olds (1966). Seven categories contained the greatest frequency of responses and accounted for 47.8 percent of the total responses. Another seven categories in which a lesser frequency of responses (33 percent) were noted: with the evidence that the children's responses more frequently fell into some categories and not at all into other categories, it is believed that the students indicated some topical preferences in science.

The categories chosen most frequently were designated as primary choices. These choices were: fields of study, III; science material, IV; experimentation in science, X; the difficulty of science, VI; relationship of science and schools, VII; fun and interesting, IX. It is found in dealing with the eight-year-old child that the expansion and/or the detail of

their responses are as great as was found in the studies that dealt with older age children (Lowery, 1966).

The category, fun and interesting, is the one most often given in the response to the lead in "Science is _____." The children most readily and enthusiastically would indicate that science is fun. This response was found by Perrodin (1966) at the fourth grade level and also as responses of students in general. It is apparent that these children did not have negative feelings about science and expressed their positive reactions by the use of this category.

It should be noted that there were categories which remained empty. The following categories did not have any of the children's responses listed under them: destructive forces and relationship of science to religion. Also, there were categories in which less than five responses were recorded out of the possible 1659 total responses to the items on the PTOA. These categories were: precious elements; strange creatures or monsters; failure in science undertaking; expense in the maintenance of science.

It is interesting to note that the children in this study did not discuss monsters in relation with science. Creatures and monsters are thought to be part of this age child's fantasy and imagination. These ideas and creatures were not mentioned frequently by the primary students.

The category, air and space, was not mentioned as frequently as was anticipated in light of the fact that Apollo 17 was an event which occurred during the administration of the PTOA. This coincides with the commentary by Daniel

Greenberg, Editor, Science and Government Report. When asked "What will be the future of NASA?" Greenberg replied, "Nobody notices NASA much anymore, it has blended into the Washington atmosphere . . .". Scientists and those in associated fields have begun to worry whether the public still loves them or whether the dark ages are returning. However, polls have shown that the attitudes of the people of this country remain positive toward the scientific community and they look to it along with technology to save society. (BioScience, 1977)

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LIST OF RESPONSE CATEGORIES

I. Words which relate to plant and/or animal life.

II. Words which relate to air travel or space exploration.

III. Words which relate to man including professions, fields of study (scientific and non-scientific), areas of health, human aspect of helpfulness.

IV. Words which relate to science materials, precious elements, and the aspect of science in building, making or doing.

V. Words which relate to the negative aspects of science such as destructive forces, monsters, danger, scientific failures and expense of maintenance of science undertakings.

VI. Words which relate to the difficulty of science and suggest the relationship of it to intelligence.

VII. Words which relate science to reading and/or school.

VIII. Words which cannot be categorized.

IX. Words which indicate that science is fun and interesting.

X. Words which relate to experimentation in science.

TABLE 4

Analysis of Variance for Means of PTOA Categorical response Scores Classified by Treatment and Sex; Category I, Plants and/or Animals

SV	df	SS	MS	F
Treatment	1	1.496	1.496	1.130
Sex	1	5.987	5.987	4.521*
Treatment x Sex	1	.126	.126	.095
Error	75	99.327	1.324	

Note: F95 with 1,75 degrees of freedom= 3.97
*Significant at the .05 level.